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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/003,113	12/06/2001	Shunichi Sekiguchi	216934US2	5214

22850 7590 05/31/2005

OBLON, SPIVAK, MCCLELLAND, MAIER & NEUSTADT, P.C.
1940 DUKE STREET
ALEXANDRIA, VA 22314

EXAMINER	
HUNG, YUBIN	
ART UNIT	**PAPER NUMBER**
2625	

DATE MAILED: 05/31/2005

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	10/003,113	SEKIGUCHI ET AL.	
	Examiner	Art Unit	
	Yubin Hung	2625	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *09 February 2005*.

2a)☒ This action is **FINAL**. 2b)☐ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-29* is/are pending in the application.

4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-29* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *06 December 2001* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

a)☒ All b)☐ Some * c)☐ None of:

1.☒ Certified copies of the priority documents have been received.

2.☐ Certified copies of the priority documents have been received in Application No. _____.

3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)
2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08) Paper No(s)/Mail Date _____.
4) ☐ Interview Summary (PTO-413) Paper No(s)/Mail Date. _____.
5) ☐ Notice of Informal Patent Application (PTO-152)
6) ☐ Other: _____.

Response to Amendment/Arguments

- This action is in response to amendment filed 02/09/2005.

- Claims 1-29 are still pending.

- In view of applicant's amendment, the objection to the specification is withdrawn.

- In view of the applicant's amendment, the 35 USC § 112 rejections have been withdrawn.

- Applicant's arguments with respect to claims 1, 8, 16 and 28 have been considered but are moot in view of the new ground(s) of rejection. See below.

DETAILED ACTION

Claim Rejections - 35 USC § 103

1. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negatived by the manner in which the invention was made.

2. Claims 1-3, 8, 12, 16, 20, 21, 28, and 29 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), in view of Fu et al. (US 5,703,965) and Fan (US 5,495,538).

3. Regarding claim 1, and similarly claims 8, 16, 28 and 29, Ishikawa discloses

- extracting edge information which represents an edge part of said original image
  [Fig. 1, ref. 14)
- obtaining density information of an edge smoothed image from said original image by smoothing said edge part
  [Fig. 1, ref. 11; Figs. 6, 7; Col. 7, lines 34-37. Note that edges are smoothed in the process]
- obtaining coded edge information by coding said edge information according to first coding algorithm
  [Fig. 1, ref. 16]
- obtaining coded density information by coding said density information of said edge smoothed image according to second coding algorithm
  [Fig. 1, ref. 13]

- sending said coded edge information and said coded density information as said coded information to said image decoding apparatus
  [Fig. 1]

- obtaining said edge information by decoding said coded edge information according to a first decoding algorithm corresponding to said first coding algorithm
  [Fig. 1, ref. 22]
- obtaining said density information of said edge smoothed image by decoding said coded density information according to second decoding algorithm corresponding said second coding algorithm
  [Fig. 1, ref. 21]

Ishikawa does not expressly discloses

- obtaining said reproduced image from said density information of said edge smoothed image by sharpening said edge part of said edge smoothed image by using said edge information
- **(new limitation) wherein said second algorithm and said second decoding algorithm are based on a standard coding method using a discrete cosine transform**

However, Fu teaches/suggests using decoded edge information to sharpen decoded density image [Fig. 5, refs. 402, 500; Figs. 12, 13; Col. 18, line 46 – Col. 19, line 28]. Further, Fan discloses using DCT to code (and therefore decode) a smoothed image [Abstract].

Ishikawa, Fu and Fan are combinable because they are from the same field of endeavor of compression/decompression.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify Ishikawa with the teachings of Fu and Fan by using decoded edge information to sharpen the edge part of the decoded density image and using DCT for the second encoding and decoding algorithms. The motivation for doing so would have been to enhance the perceptual quality of the reconstructed image, as indicated in Col. 4, lines 34-36 of Fu as well as the wide acceptance of the DCT as a basic ingredient of compression standards such as JPEG and MPEG and the availability of software and hardware implementation of such standards (e.g., Fan, Col. 1, lines 30-52 and Col. 2, lines 5-8).

Therefore, it would have been obvious to combine Fu and Fan with Ishikawa to obtain the invention of claim 1.

4. Regarding claim 2, and similarly claim 12, Ishikawa further discloses

- performing first matrix operation by using a first block density information vector and smoothing matrix, wherein said first block density information vector is obtained by arranging density information of each pixel included in a first block, said first block includes a pixel in said edge part or in a near region of said edge part and includes pixels in a surrounding region around said pixel, and order of said first block density information, vector corresponds to the number of pixels in said first block, and wherein said smoothing matrix includes coefficients used for edge smoothing which operate on density information of each pixel in said first block
[Fig. 6 (smoothing matrix); Fig. 7 (the block on the left is the first block)]
- obtaining smoothed density information of each pixel by overlaying density information of each pixel in said first block obtained by performing said first matrix operation on each pixel while scanning said original image pixel by pixel
[Figs. 6, 7; Col. 7, lines 34-37]

5. Claim 3, and similarly claims 20 and 21, is drawn to the application of the sharpening operation, which is identical to the application of the smoothing operation recited in claim except for the matrix used. Since it is well known in the art that sharpening is essentially the inverse of smoothing, therefore it would have been obvious to one of ordinary skill in the art to use the inverse matrix of the smoothing matrix for the sharpening operation. Along with this, claim 3 is similarly analyzed and rejected as per claim 2.

***

6. Claims 4-6, 15, 25 and 26 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965) and Fan (US 5,495,538) as applied to claims 1-3, 8, 12, 16, 20, 21, 28, and 29, and further in view of Murakami et al. (US RE35,414).

7. Regarding claim 4, and similarly claim 15, the combined invention of Ishikawa, Fu and Fan discloses all limitations of its parent, claim 1.

The combined invention of Ishikawa, Fu and Fan does not expressly disclose that said image coding apparatus smoothes said edge part by performing the steps of:

- obtaining density information x' of a pixel of said edge part of said edge smoothed image according to a first equation $x'=(1-\lambda)x+\lambda C$, wherein, λ is a positive constant, x is density information of said pixel of said original image, and C is surrounding density information representing density state of surrounding region of said pixel

However, Murakami teaches/suggests using a weighted filter as described above to perform the smoothing operation [Fig. 40; Fig. 42, ref. 117; Col. 27, lines 55-65; Col. 29, lines 47-50.].

The combined invention of Ishikawa, Fu and Fan is combinable with Murakami because they are from the same field of endeavor of compression/decompression.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu and Fan with the teaching of Murakami by using the specific smoothing filter. The motivation for doing so would have been because it is effective, easy to implement, and most important, adaptive. [See Col. 27, line 66 – Col. 28, line 13 on the adaptive feature.]

Therefore, it would have been obvious to combine Murakami with Ishikawa, Fu and Fan to obtain the invention of claim 4.

8. Regarding claims 5 and 6, note that from the first equation recited in claim 4, x can be expressed as $(x' - \lambda C)/ (1-\lambda)$ which is the inverse of the smoothing operation performed using the first equation and per the analysis of claim 3, is an obvious choice for sharpening. Moreover, given the smoothed edge density information (i.e., x'), x" = $(x' - \lambda C)/ (1-\lambda)$ is an obvious estimate of the original x, which of course is the best sharpening result that can be obtained (in the sense of restoring the compressed image with the highest fidelity). On the other hand, the predetermined equation $e(X) = (X+ (\lambda C(n) – x')/ (1-\lambda))^2$ recited in claim 6 expresses the well-known squared errors of a value X and its estimate

$Z = (x' – \lambda C(n))/ (1-\lambda)$ and can be minimized using the also well-known steepest-descent approach.

Therefore, it would have been obvious to one of ordinary skill in the art to use the steepest-descent approach to determine the X that minimizes e(X). Claims 5 and 6 are therefore rejected due to obviousness.

(Examiner's comment: Note, however, in this special case it is clear that when C(n) is chosen in the obvious manner such that C(n) = C (as defined in the first equation), x" will minimize e(X) because

$e(x") = (x"+ (\lambda C - x')/ (1-\lambda))^2 = ((x' - \lambda C)/ (1-\lambda)+ (\lambda C - x')/ (1-\lambda))^2 = 0.)$

9. Claim 25 is similarly analyzed and rejected as per the analyses of claims 4 and 5.

10. Claim 26 is similarly analyzed and rejected as per the analysis of claim6.

***

11. Claims 7 and 27 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965), Fan (US 5,495,538) and Murakami et al. (US RE35,414) as applied to claims 4-6, 15, 25 and 26, and further in view of Webb et al. (US 6,621,909).

12. Regarding claim 7, and similarly claim 27, the combined invention of Ishikawa, Fu, Fan and Murakami discloses all limitations of its parent, claim 6.

The combined invention of Ishikawa, Fu, Fan and Murakami does not expressly disclose

- in a process according to said steepest-descent method, X is obtained as a convergence value of a recurrence formula $X(n+1)= X(n)- G*(\delta e/\delta X)$, wherein G is constant.

However, Webb teaches/suggests obtaining X as a convergence value of a recurrence formula $X(n+1)= X(n)- G*(\delta e/\delta X)$, wherein G is constant. [See Col. 4, lines 32-67.]

The combined invention of Ishikawa, Fu, Fan and Murakami is combinable with Webb because they solve the same optimization problem.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu, Fan and Murakami with the teaching of Webb by obtaining X as a convergence value of a recurrence formula $X(n+1)= X(n)-G^*(\delta e/\delta X)$. The motivation for doing so would have been because it has been shown to be capable of minimizing the total magnitude square errors, as Webb indicated in Col. 4, lines 50-55.

Therefore, it would have been obvious to combine Webb with Ishikawa Fu, Fan and Murakami to obtain the invention of claim 7.

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13. Claims 9, 10, 17 and 18 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965) and Fan (US 5,495,538) as applied to claims 1-3, 8, 12, 16, 20, 21, 28, and 29, and further in view of Su (US 4,162,482).

14. Regarding claim 9, the combined invention of Ishikawa, Fu and Fan discloses all limitations of its parent, claim 8.

The combined invention of Ishikawa, Fu and Fan does not expressly disclose

- said edge smoothing part including a density information correction part for correcting density information of each pixel such that variation of density levels represented by density information of pixels which are arranged across said edge part in a near region of said edge part of said original image is lowered

However, Su teaches/suggests removing noise (i.e., performing correction) prior to smoothing the edges (and therefore is considered part of the smoothing) [Fig. 1, refs. 5, 9; Col. 3, lines 46-58].

The combined invention of Ishikawa, Fu and Fan is combinable with Su because they have aspects that are from the same field of endeavor of edge detection.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu and Fan with the teaching of Su by removing noise (i.e., performing correction) prior to smoothing the edges. The motivation for doing so would have been to remove noise so as to obtain a better smoothing result.

Therefore, it would have been obvious to combine Su with Ishikawa, Fu and Fan to obtain the invention of claim 9.

15. Regarding claim 10, Ishikawa further discloses

- said density information correction part a mean value calculation part calculating mean value of said density levels in predetermined region; and a density level judgment part for judging whether said density level of a pixel is higher or lower than said mean value for each pixel in said near region; wherein density information is corrected for a pixel in which said density level is higher than said mean value such that said density level is lowered, and density information is corrected for a pixel in which said density level is lower than said mean value such that said density level increased
[Figs. 6 and 7. Note that by replacing (i.e., correcting) a target pixel value with the average of its neighbors', the new mean will be lowered if the original target pixel value is higher than the original mean, and vice versa]

16. Regarding claim 17, it is similarly analyzed and rejected as per the analysis of claim 9 because it is its decoding counter part and therefore is obvious and also because performing similar image correction can improve the sharpening result.

17. Regarding claim 18, it is similarly analyzed and rejected as per the analysis of claim 10 because it is its decoding counter part and therefore is obvious.

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18. Claims 11 and 19 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965), Fan (US 5,495,538) and Su (US 4,162,482) as applied to claims 9, 10, 17 and 18, and further in view of Lee et al. (US 5,612,744).

19. Regarding claim 11, the combined invention of Ishikawa, Fu, Fan and Su discloses all limitations of its parent, claim 10.

The combined invention of Ishikawa, Fu, Fan and Su does not expressly disclose

- wherein said density information correction part corrects density information of each pixel in said near region such that said mean value of said density levels does change

However, Lee teaches/suggests preserving mean values [Fig. 2, ref. 26; Col. 4, lines 21-27.

The combined invention of Ishikawa, Fu and Fan is combinable with Su because they have aspects that are from the same field of endeavor of edge detection.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu, Fan and Su with the teaching of Lee by preserving the mean values. The motivation for doing so would have been because in this way the results will be more pleasing, as Lee indicated in Col. 4, lines 27-30.

Therefore, it would have been obvious to combine Lee with Ishikawa, Fu, Fan and Su to obtain the invention of claim 11.

20. Regarding claim 19, it is similarly analyzed and rejected as per the analysis of claim 11 because it is its decoding counter part and therefore is obvious.

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21. Claims 13, 22 and 24 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965) and Fan (US 5,495,538) as applied to claims 1-3, 8, 12, 16, 20, 21, 28, and 29, and further in view of Acharya et al. (US 6,229,578).

22. Regarding claim 13, the combined invention of Ishikawa, Fu and Fan discloses all limitations of its parent, claim 8 and, per the analysis of claims 2 and 12, the following:

- a matrix operation part for performing matrix operation by using a block density information vector and a smoothing matrix, wherein said block density information vector is obtained by arranging density information of each pixel included in a block, said block includes said pixel and pixels in surrounding region around said pixel, and order of said block density information vector corresponds to the number of pixels in said block, and wherein said smoothing matrix includes coefficients used for edge smoothing which operate on density information of each pixel said block
- an operation part for obtaining smoothed density information of each pixel by overlaying density information of each pixel said block obtained by performing said matrix operation on each pixel while scanning said original image pixel by pixel

The combined invention of Ishikawa, Fu and Fan does not expressly disclose

- a pixel judgment part for judging whether a pixel exists in said edge part or in a near region of said edge part while scanning said original image pixel by pixel
- the matrix operation part for performing, when said pixel exists in said edge part or in said near region

However, Acharya teaches/suggests judging whether a pixel is an edge pixel [Fig. 1, ref. 140] and performing smoothing (by averaging, which can be implemented as a

matrix operation, as taught by Ishikawa, per the analysis of claim 2) when it is [Fig. 1, ref. 150].

The combined invention of Ishikawa, Fu and Fan is combinable with Acharya because they have aspects that are from the same field of endeavor of edge detection.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu and Fan with the teaching of Acharya by judging whether a pixel is an edge pixel and performing smoothing when it is. The motivation for doing so would have been because noise may also be present in a pixel judged as an edge pixel, as Acharya indicated in Col. 5, lines 45-48.

Therefore, it would have been obvious to combine Acharya with Ishikawa, Fu and Fan to obtain the invention of claim 13.

23. Regarding claim 22, it is the reverse (i.e., decoding) of the coding apparatus of claim 13 and therefore is rejected based on obviousness.

24. Claim 24 is similarly analyzed as per the analyses of claims 3 and 22.

***

25. Claims 14 and 23 are rejected under 35 U.S.C. 103(a) as being unpatentable over Ishikawa et al. (US 5,862,264), Fu et al. (US 5,703,965), Fan (US 5,495,538) and Acharya et al. (US 6,229,578) as applied to claims 13, 22 and 24, and further in view of Futamura (US 5,791,271).

26. Regarding claim 14, the combined invention of Ishikawa, Fu, Fan and Acharya discloses all limitations of its parent, claim 13.

The combined invention of Ishikawa, Fu, Fan and Acharya does not expressly disclose

- a distance conversion part for generating distance information representing distances between said edge part and each pixel
- a distance judgment part for judging whether said distance information for each pixel is equal to or smaller than a predetermined value; wherein, when said distance information is judged to be equal to or smaller than said predetermined value, it is judged that a pixel corresponding to said distance information exists in said edge part or in said near region

However, Futamura teaches/suggests generating distance map [Fig. 6, ref. S32; Figs. 7A,7B, 8; Col. 6, lines 37-53]and based on the distance, determines whether a pixel is on or near an edge [Fig. 6, ref. S33; Col. 6, lines 54-55, 62-64].

The combined invention of Ishikawa, Fu, Fan and Acharya is combinable with Futamura because they have aspects that are from the same field of endeavor of feature extraction.

At the time of the invention, it would have been obvious to one of ordinary skill in the art to modify the combined invention of Ishikawa, Fu and Acharya with the teaching of Futamura by generating a distance map and based on the distance, determining whether a pixel is on or near an edge. The motivation for doing so would have been because it offers an efficient way to identify points close to edges or borders so further manipulation such as border adjustment can be performed, as Futamura indicated in Col. 6, lines 62-64.

Therefore, it would have been obvious to combine Futamura with Ishikawa, Fu, Fan and Acharya to obtain the invention of claim 14.

27. Regarding claim 23, it is similarly analyzed and rejected as per the analysis of claim 14 because it is its decoding counter part and therefore is obvious.

Conclusion and Contact Information

28. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure:

- Mitra et al. (US 5,426,673) – Discloses a DCT-based image coding/decoding method that applies DCT to edge-smoothed images

29. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

30. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Yubin Hung whose telephone number is (571) 272-7451. The examiner can normally be reached on 7:30 - 4:00.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bhavesh Mehta can be reached on (571) 272-7453. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

Yubin Hung
Patent Examiner
May 20, 2005

BHAVESH M. MEHTA
SUPERVISORY PATENT EXAMINER
TECHNOLOGY CENTER 2600